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| 10/587,546 | 01/05/2007 | Jinbo Bai | BJS-5006-11 | 9696 |
| 23117 7590 06/23/2009 NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203 | | | | |
| EXAMINER | | | | |
| MCCRACKEN, DANIEL | | | | |
| ART UNIT | | PAPER NUMBER | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/587,546

Applicant(s)

BAI ET AL.

Examiner

DANIEL C. MCCracken

Art Unit

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/5/2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SF/ICE)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Status of Application

Applicants preliminary amendment to the specification (claiming foreign priority) and adding an abstract filed 7/28/2006 has been received and will be entered. Applicants preliminary amendment to the claims (removing multiple dependencies) filed 1/5/2007 has been received and will be entered. Claims 1-12 are pending.

Drawings

New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because, while it would appear as if copies were present in the PCT filing (as evidenced by the WIPO pub (WO 2005/075341), they are not present in the file wrapper.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5 is not understood in light of Claim 1. Claim 1 requires "the addition of a compound as a carbon source containing a catalyst" which would appear to suggest one of the conventional organometallics employed in nanotube synthesis (ferrocene, etc.). Claim 5 limits the carbon source to sources that do not contain a catalyst – at least not in the conventional sense. None of the hydrocarbons recited contain a catalyst as required by Claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7 and 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Ma, et al., *Catalytic growth of carbon nanofibers on a porous carbon nanotubes substrate*, J. Mater. Sci. Letters 2000; 19: 1329-1931 (hereinafter "Ma at ___").

With respect to claim 1, and notwithstanding the ambiguities noted in the rejections under 35 U.S.C. 112 *supra*, Ma discloses a CVD process for growing nanotubes wherein a hydrocarbon, inert and hydrogen are introduced into a reactor. (Ma at 1930) ("Fig. 1"). As to Claims 2-4, a support of carbon fibers is utilized. (Ma at 1929, col. 2). A temperature of 750 C is

taught. *Id.* As to Claim 5, propylene is taught. (Ma at 1930) ("Fig. 1"). As to Claim 6, nickel nitrates are taught. (Ma at 1929, col. 2). As to claim 7, the concentration appears to be taught. *Id.* (0.1 M). As to Claim 11, the products are taught. (Ma at 1130, "Fig. 5"). As to Claim 12, note that - at least according to Applicants definition of "ceramic" in Claim 4 - nanotubes bonded to a ceramic (i.e. carbon nanotube/nanofiber) matrix is taught. *Id.*

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128-141 (hereinafter "Rao at ___") in view of Ma, et al., *Processing and properties of carbon nanotubes-nano-SiC ceramic*, Journal of Materials Science 1998; 33: 5243-5246 (hereinafter "Ma II at ___"). .

With respect to Claim 1, Rao teaches a CVD method for growing carbon nanotubes. *See generally* (Rao at 129 *et seq.*) (“Experimental”). Notwithstanding the ambiguities noted in the rejections under 35 U.S.C. 112 *supra*, Rao teaches argon (*i.e.* an inert), hydrogen, and benzene (*i.e.* a carbon source). *See e.g.* (Rao at 129) (“Fig.”). As to Claim 2, temperatures of 1173 and 1373 K (*i.e.* approx 900 and 1100 C) are taught. (Rao at 130). Recovery details are taught at (Rao at 132, col. 1) (sonication). To the extent Rao doesn’t recite *in haec verba* “cooling to room temperature,” it is expected that this step necessarily occurs, as evidenced by the micrographs. Stated differently, it is highly unlikely that 1100 C nanotubes were placed in a microscope. This is the evidence offered to show inherency. As to Claim 5, benzene is taught. (Rao at 129). As to Claim 6, ferrocene and iron pentacarbonyl are taught. *Id.* As to claim 7, the ratios appear to be taught. (Rao at 132, col. 1). To the extent they aren’t, it is axiomatic that the amount of catalyst necessarily effects the rate of reaction, conversion, etc., and is readily optimized. Note also the discussion at (Rao at 133, col. 2) suggesting controlling the relative amounts. As to Claim 8, note the ratios taught at (Rao at 132, col. 1).

To the extent Rao *may* not teach the substrate/support (*i.e.* “ceramic material”) required by the claims (Claims 2-4 and 9-10), this does not impart patentability. Ma II teaches that SiC coupled with carbon nanotubes might improve the brittleness of ceramics. (Ma II at 5243). One would be motivated to grow nanotubes on SiC for any number of reasons, for example the elimination of the mixing step Ma II employs to make their ceramics/composites.

Claims 2-4 and 9-10 rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and*

nanorods by employing organometallic precursors, Mat Res Innovat 1998; 2: 128–141 as applied to claim 1 above, and further in view of US 2003/0119920 to Wang, et al..

The preceding discussion of Rao is expressly incorporated herein by reference. With respect to supports of Claims 2-4 and 9-10 – to the extent they are not taught by Rao, they are disclosed by Wang. *See* (Wang 3: [0042]). Growth of the nanotubes on the supports taught by Wang would allow for incorporation into the structures suggested by Wang. *See* (Wang 3: [0043] *et seq.*).

Claims 2-4 and 9-10 rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 and US 2003/0119920 to Wang, et al.. as applied to claim 1 above, and further in view of US 2006/0052509 to Saitoh.

The preceding discussion of Rao and Wang is expressly incorporated herein by reference. To the extent Claims 9-10 require the coating of the support with a silane, and to the extent neither Rao or Wang discloses such a step, Saitoh discloses that silanes are useful in nanotube compositions as coupling agents. (Saitoh 15: [0092]). One would be motivated to coat the supports of Rao and Wang with the silanes of Saitoh to aid in incorporation into other compositions, as suggested by Saitoh. (Saitoh 1: [0012] *et seq.*).

Conclusion

Those references cited on the international search report are considered relevant to Applicants disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCracken whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Daniel C. McCracken/
Daniel C. McCracken
Examiner, Art Unit 1793
DCM

/Stuart L. Hendrickson/
Primary examiner Art Unit 1793

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